Delayed termination of ventricular tachycardia after cardioversion

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Both anti-tachycardia pacing and cardioversion via an implantable cardioverter defibrillator are effective therapies for ventricular tachycardia (VT). We report a case of VT where cardioversion resulted in delayed termination of tachycardia. Potential mechanisms for this observation are discussed.

Case report

A 72-year-old woman with ischaemic cardiomyopathy and an implantable cardioverter defibrillator (ICD) presented following two shocks (Epic VR, St Jude Medical, St Paul, MN, USA). The ICD was implanted 18 months earlier for treatment of clinical ventricular tachycardia (VT). At implant, the defibrillation threshold was <20J. The device was programmed to deliver anti-tachycardia pacing followed by cardioversions for rhythms between 154 and 200 bpm, and 30J defibrillation for rates >200 bpm. Interrogation of her ICD demonstrated 10 episodes of VT; eight episodes fell within the VT zone and successfully pace terminated on the first attempt, whereas two episodes were >200 bpm and 30J shocks were delivered. One of the latter episodes is shown in Figure 1 (the other is near identical and not shown). Demonstrated is the abrupt onset tachycardia with a cycle length of 300 ms (Panel 1). The device appropriately senses the tachycardia and delivers a 30J defibrillation (Panel 2). Following the fixed 1000 ms blanking period, the tachycardia is initially irregular, and then resumes at an identical cycle length (Panel 3). However, after ~30 beats, tachycardia spontaneously terminates without the need for further therapy (Panel 4). The defibrillation threshold was re-evaluated and found to be <20J. During electrophysiology study, VT was induced by programmed ventricular extrastimuli and this broad complex tachycardia demonstrated identical electrogram morphology on device interrogation to that shown in Figure 1. The device was re-programmed so that anti-tachycardia pacing was the initial therapy given for rates up to 220 bpm. She has not received further therapy from her device.

Delayed cardioversion after DC shock for atrial and ventricular fibrillation has been described. Non-sustained VT has been observed to follow 6% of ICD shocks for ventricular arrhythmias; however, the mechanism is unclear. Delayed termination of re-entrant rhythm models has been shown with large amplitude shocks delivered out of phase, in contrast to clean termination with intermediate amplitude shocks irrespective of phase. This patient demonstrates two episodes of self-terminating VT following an above-defibrillation-threshold shock for a rhythm readily treatable with pacing. This may be because of tachycardia termination and re-initiation by ventricular ectopics in the post-discharge period, or continuation of the tachycardia after a large amplitude shock delivered out of phase leading to delayed termination.

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Conflict of interest

P.S. receives research and fellowship funding from St Jude Medical and Medtronic Inc, is a member of the Speaker’s Bureau for St Jude Medical, and is a member of an advisory board for Medtronic Inc.
Figure 1  ICD interrogation for the first episode of delayed termination of VT after cardioversion.